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Preliminary Results from the Space Probe Pioneer V¹

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The space probe Pioneer V was launched March 11, 1960, into an orbit around the sun and inside the orbit of earth. The scientific apparatus included instruments identical with the University of Chicago apparatus used on Explorer VI [Fan, Meyer, and Simpson, 1960b], namely, energetic particle detectors which measure fluxes of protons with energies greater than 75 Mev, electrons with energies greater than 15 Mev, and the bremsstrahlung from electrons and γ rays of lower energy. Simultaneously with the measurements in Pioneer V a series of four neutron monitor piles were recording the changes

in cosmic radiation intensity at the earth. We report here on some preliminary results obtained from the Chicago experiments during the time within which Pioneer V traveled to a distance of approximately 8×10^6 km from earth. Beginning on March 20, solar activity rapidly increased with many solar flares, radio noise bursts, etc., over a period of 10 days. Most of our results relate to this period. The preliminary data are given in Figures 1 and 2.

¹ Presented at the meeting of the American Geophysical Union, Washington, D. C., April 30, 1960.

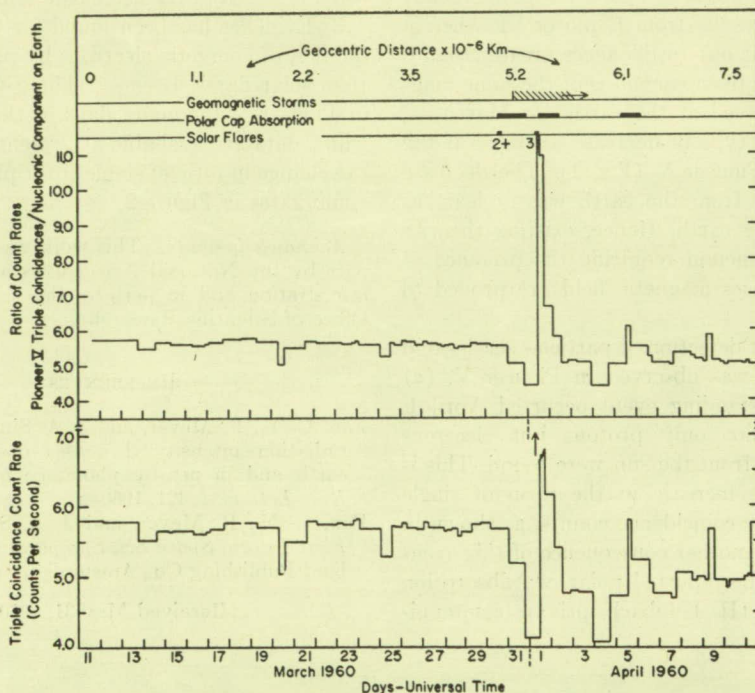


Fig. 1. Geomagnetic storms, polar cap absorption, and solar flares.

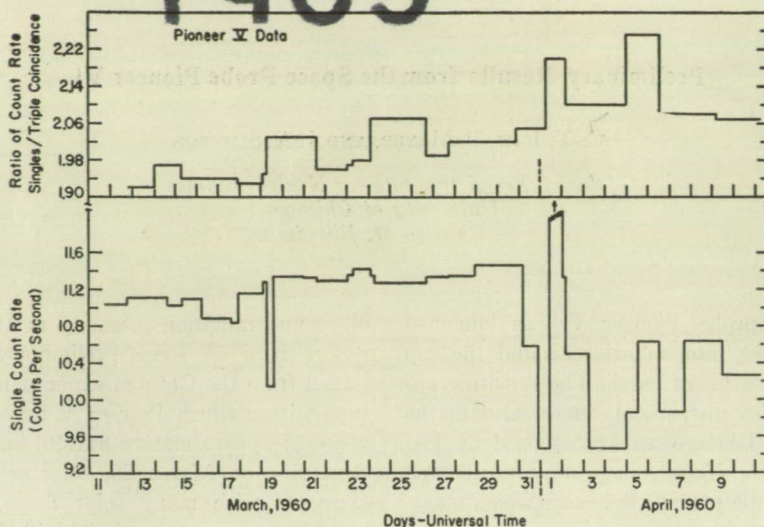


Fig. 2. Pioneer V data.

1. Experimental tests to identify the electromagnetic modulation mechanism for the sudden decreases of galactic cosmic-ray intensity (Forbush-type decreases) have been discussed in a recent paper [Fan, Meyer, and Simpson, 1960a] reporting the results from Explorer VI, wherein it is shown that out to distances greater than 8 earth radii this phenomenon is of the same magnitude as observed at the earth. On March 31, 1960, a similar type of decrease occurred at the earth and at Pioneer V (Fig. 1). The decrease at 5×10^6 km from the earth was at least as great as at the earth. Hence, existing theories for this phenomenon requiring the presence of the earth and its magnetic field are proved to be invalid.

2. The direct detection of particles accelerated in solar flares was observed in Pioneer V. (a) The most outstanding event occurred April 1, 1960, where not only protons but electrons and/or γ rays from the sun were found. This is proved by the increase in the ratio of single counts to triple-coincidence counts, as shown in Figure 2. (b) Another consequence of this event follows from the reported polar cap absorption of radio noise (H. Leinbach, private communi-

cation) in coincidence with the increase of particle flux at the position of Pioneer V. This shows that the solar flare particles producing the ionization in the polar atmosphere for many hours are not stored in the geomagnetic field.

3. Evidence has been found for the solar production of energetic electrons by processes other than solar flares. Bremsstrahlung was measured in Pioneer V for many days of the period over which data are available at present as shown by the change in ratio of single- to triple-coincidence count rates in Figure 2.

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